
**Earth-moving machinery — Loaders
and backhoe loaders —**

Part 2:

**Test method for measuring breakout forces
and lift capacity to maximum lift height**

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Engins de terrassement — Chargeuses et chargeuses-pelleteuses—

*(Partie 2: Méthode d'essai pour mesurer les forces d'arrachement et la
capacité de levage à la hauteur de levage maximale*

ISO 14397-2:2002

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 14397 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 14397-2 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 1, *Test methods relating to machine performance*.

ISO 14397 consists of the following parts, under the general title *Earth-moving machinery — Loaders and backhoe loaders*:

— *Part 1: Calculation of rated operating capacity and test method for verifying calculated tipping load*

— *Part 2: Test method for measuring breakout forces and lift capacity to maximum lift height*

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Earth-moving machinery — Loaders and backhoe loaders —

Part 2:

Test method for measuring breakout forces and lift capacity to maximum lift height

1 Scope

This part of ISO 14397 specifies a test method for measuring the breakout forces and the lift capacities to maximum lift height of wheel and crawler loaders and the loader portion of backhoe loaders, as these machine types are defined in ISO 6165.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 14397. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 14397 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 6016:1998, *Earth-moving machinery — Methods of measuring the masses of whole machines, their equipment and components*

ISO 6165:2001, *Earth-moving machinery — Basic types — Vocabulary*

ISO 6746-1:1987, *Earth-moving machinery — Definitions of dimensions and symbols — Part 1: Base machine*

ISO 7546:1983, *Earth-moving machinery — Loader and front loading excavator buckets — Volumetric ratings*

ISO 9248:1992, *Earth-moving machinery — Units for dimensions, performance and capacities, and their measurement accuracies*

ISO 14397-1, *Earth-moving machinery — Loaders and backhoe loaders — Part 1: Calculation of rated operating capacity and test method for verifying calculated tipping load*

3 Terms, definitions and symbols

For the purposes of this part of ISO 14397, the terms, definitions and symbols given in ISO 6165, ISO 6746-1 and ISO 14397-1, and the following terms and definitions apply.

3.1

breakout force

maximum sustained upward vertical force, in newtons, generated at a point 100 mm behind the lip of the bucket of a loader by a lift or tilt cylinder, with the bottom of the bucket's cutting edge parallel to, and not more than 20 mm

above, ground reference point (GRP); it is measured 100 mm behind the foremost point of the cutting edge for loaders having buckets with an irregular (pointed, curved, etc.) cutting-edge shape

NOTE See Figures 1 and 2.

3.2 hydraulic circuit working pressure

pressure applied to the specific hydraulic lifting circuit by the hydraulic pump(s)

3.3 hydraulic circuit holding pressure

maximum static pressure in a specific circuit limited by a relief valve at a flow not exceeding 10 % of the rated circuit flow

3.4 hydraulic limiting condition

condition in which the breakout force or lift capacity is limited by the hydraulic circuit working or holding pressure

4 Apparatus

4.1 Load cell or force transducer, appropriate to the magnitude of the tool force to be measured and having an accuracy in conformance with ISO 9248.

4.2 Hydraulic oil pressure gauge or transducer, appropriate to the magnitude of the tool force to be measured and having an accuracy in conformance with ISO 9248.

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5 Test conditions

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5.1 Test site

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The test site shall consist of a hard, substantially level surface, preferably of concrete, which shall have anchor points and sufficient space for a scale or load-measuring device.

5.2 Preparation

5.2.1 General

The loader under test shall be clean and generally equipped in accordance with ISO 6016. It shall be of a standard configuration as specified by the manufacturer. During testing, the loader's transmission shall be in neutral and its brakes released.

Backhoe loaders shall have their loader portion in the standard configuration and their backhoe in the transport position, as specified by the manufacturer.

5.2.2 Specific conditions

If breakout force and lift capacity are determined under specific conditions such as with additional counterweight, ripper, backhoe, or tyre ballast, then these conditions shall be specified in the operator's manual and in advertising literature, with the stable operating conditions specified in ISO 14397-1 clearly described.

5.2.3 Bucket

The bucket shall be empty and in the positions, as applicable, shown in Figures 1, 2 and 3.

5.2.4 Test equipment

Typical arrangements of the test equipment, which shall be positioned on the test site, are shown in Figures 1, 2 and 3.

Safety chains shall be fitted to prevent the machine from overturning during tests where tipping limits will be reached or exceeded. These chains shall be loose enough to allow the machine to reach a tipping limit condition while at the same time preventing it from overturning.

6 Test method

6.1 General

The breakout force and lift capacities shall be measured in accordance with the general requirements of 6.2 and, as applicable, in accordance with the specific requirements of 6.3 and 6.4 and according to Figures 1, 2 or 3.

The tests shall be conducted with the machine running in accordance with the manufacturer's operating instructions and all safety rules.

6.2 Test procedure

6.2.1 With the drive system in neutral and the brakes released, position the loader on the test area with its bucket empty and suitably attached to the load cell as shown in Figure 1, 2 or 3.

6.2.2 With the engine running at the manufacturer's recommended speed, operate the cylinder or cylinders independently, and record the breakout forces and lift capacities.

6.2.3 Note and record the limiting conditions for each test in the test report. In the case of hydraulic limiting conditions, the hydraulic circuit in which the holding pressure was exceeded shall be noted. If the tipping limit condition (see ISO 14397-1) is reached in a circuit, the force obtained with that hydraulic circuit is the breakout force or lift capacity.

6.2.4 Conduct each test three times and note the maximum values for each test. Record an arithmetic mean of these three values in the test report.

6.3 Breakout force

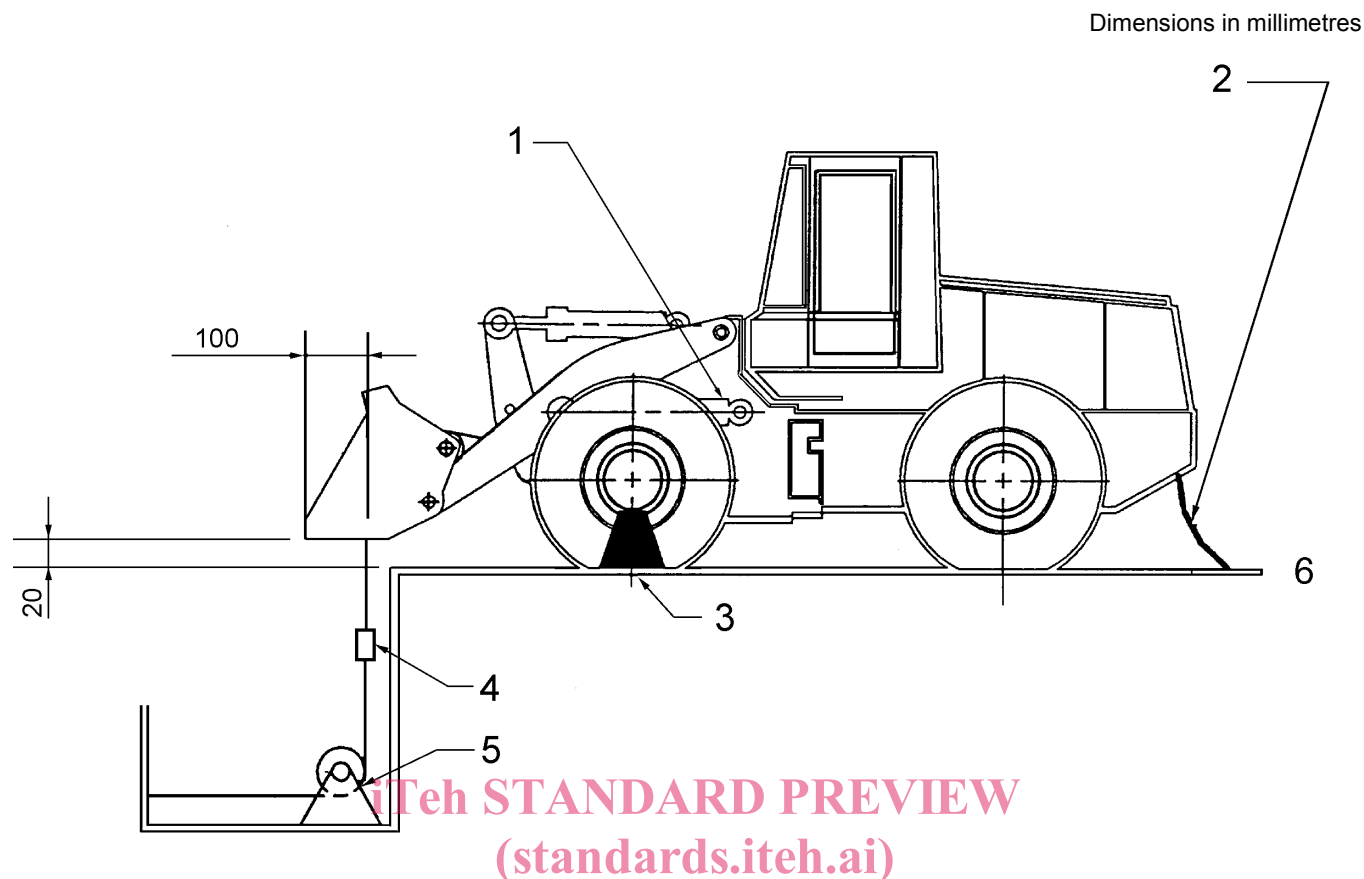
For testing the breakout force exerted by lift cylinders (see Figure 1) and that exerted by tilt cylinders (see Figure 2), the cable or linkage shall be attached 100 mm behind the bucket lip in vertical alignment with the load cell.

For tilt cylinders, in order to prevent linkage movement, the bucket shall be supported by a steel block beneath the bucket pivot (see Figure 2).

6.4 Lift capacity to maximum height

6.4.1 Operating the lift cylinder or cylinders at working pressure, apply a reactive force by means of a wire rope or other device acting vertically through the bucket centroid to the load cell.

6.4.2 Tilt back the bucket and measure the force taken with the lift cylinder or cylinders extended to within 10 mm of full stroke (see Figure 3).



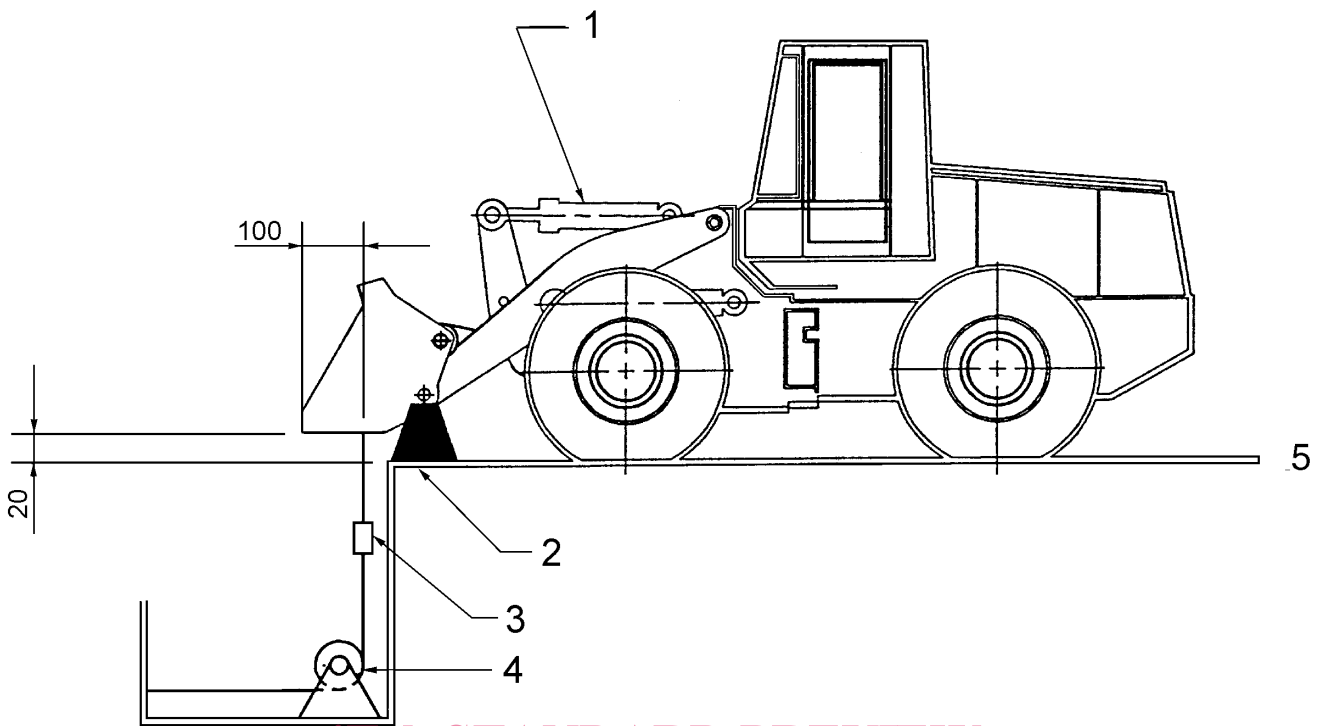
Key

- 1 Lift cylinder(s)
- 2 Loose safety chain
- 3 Support at axle centreline
- 4 Load cell
- 5 Pulley
- 6 GRP

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Figure 1 — Typical test arrangement — Breakout force — Lift cylinders

Dimensions in millimetres



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Key

- 1 Tilt cylinder(s)
- 2 Support at pivot centreline
- 3 Load cell
- 4 Pulley
- 5 GRP

ISO 14397-2:2002
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Figure 2 — Typical test arrangement — Breakout force — Tilt cylinders